

A COMPARATIVE STUDY OF PLASMA TOTAL CHOLESTEROL LEVELS AMONG UNTREATED ESSENTIAL HYPERTENSIVE AND HEALTHY NON-HYPERTENSIVE NIGERIANS

Awusi Vincent Oghenekobaro¹ and Onyeneke E.C²

¹Department of Family Medicine, Faculty of Medical Sciences, Delta State University, Abraka, Delta State, Nigeria. ²Department of Biochemistry, University Of Benin

ABSTRACT

The reported co-existence of hypertension and hypercholesterolaemia increases the probability of hypertensive patients developing premature ischaemic heart disease which is the commonest cause of sudden death.

The aim of the study was to determine significant difference between the plasma total cholesterol (Tc) levels of hypertensive and normotensive subjects and, the coronary risk status of all the subjects.

Blood samples, to estimate plasma total cholesterol levels, were obtained from 150 untreated patients with uncomplicated essential hypertension and 150 healthy normotensive controls of comparative ages, sexes and body mass index.

The hypertensive patients had significantly higher plasma total cholesterol levels (male = 189 ± 22 mg%, female = 198 ± 34 mg%) than the normotensive controls (male = 153 ± 18 mg%, female = 155 ± 15 mg%) ($P < 0.05$). Eleven (7.3%) of the hypertensives fell within the high coronary risk group (World Health Organization – WHO – classification).

It is suggested that hypertension management should include preventative counseling for a healthy lifestyle/diet, and control of plasma lipids and the raised blood pressure.

KEYWORDS: Hypertension, Hypercholesterolaemia, Ischaemic Heart Disease, Sudden Death, Preventative Counseling

INTRODUCTION

Hypertension and hypercholesterolaemia - two independent risk factors in the causation of ischaemic heart disease (IHD) – have been reported to co-exist, independent of confounding variables such as age, sex and body mass index (Adedeji *et al.*, 1990), (Bamgboye *et al.*, 1990), (Bonna *et al.*, 1991), (Amens, 1991); thus increasing the chances of hypertensive patients developing premature ischaemic heart disease (America Health Foundation, 1989) which is the commonest cause of sudden death (British Cardiac Society Working Group, 1987).

Ischaemic heart disease, therefore, should be of primary health concern as it can present first time in a patient as sudden death, which have been reported in the lay press.

Since epidemiology of hypertension in Africa has successfully debunked the earlier claim that the blacks in Africa were not sophisticated enough in life-style to be hypertensive, there is reason to research into all facets of hypertension, knowing its effects on microarteries (Edington *et al.*, 1976), consequent atherosclerosis, and eventual morbidity and mortality in middle age and beyond (Edington *et al.*, 1976), (Gordon, 1987); caused by the plaqueing of the intima by poorly metabolized lipids.

Ischaemic heart disease is partly a disease of affluence (British Cardiac Society Working Group, 1987). It is becoming more common in societies previously impoverished by history or recent circumstances, as living standard “improve” (British Cardiac Society Working Group, 1987), (Anderson *et al.*, 1991). Thus the highest socio-economic groups, the urban elite, carry special risks, and with increasing affluence generally, the prevalence of the risk factor becomes higher (Gordon, 1987). The fact that developing countries, such as Nigeria, are experiencing rapid growth in their urban population suggests that there will be a concurrent appearance of large numbers of individuals with moderate risk. This makes the largest contribution to population morbidity

and mortality. Like hypertension in the time past, IHD has been reported to be relatively rare in black Africans (Osuntokun, 1987), (Ononogbu, 1994), which has been attributed to their dietary habit of consuming diets low in fat content and rich in fibres, and their less sedentary life style (Akinkugbe, 1992), (Bamgboye *et al.*, 1990). However, the dietary habits and life-style of the Nigerian population is changing and approaching those of the western industrialized societies (Ononogbu, 1994), with the resultant probability of both societies having almost equal blood cholesterol levels and therefore almost equal risk of developing IHD.

Plasma total cholesterol (Tc) levels is currently being recommended, by the World Health Organization (WHO), for use in determining the coronary risk status of patients (WHO. Expert Committee on Prevention of Coronary Heart Disease, 1990); it shows that a Tc level of less than 220mg% is free from risk, 220-260mg% is borderline (suspicious) and, above 260mg% is considered high risk (hypercholesterolaemia requiring treatment).

The measurement of these lipid concentrations in plasma has been the subject of several studies for chronic and/or degenerative diseases, such as IHD, but mostly on the white Caucasians. It is therefore necessary to have a comparative plasma total cholesterol levels of African-Nigerian hypertensive and non-hypertensive subjects and determine whether there is any significant difference in their Tc levels and, identify those subject that have high risk of developing IHD. This in the author's opinion will help to highlight to the medical profession the increasing presence of IHD risk factors, such as hypertension and hypercholesterolaemia, in the African-Nigerian population, as it is imperative for the medical profession to possess a clear knowledge of what constitute risk factors for IHD, be in a position to recognize the groups likely to benefit from control measures and have the ability to apply them.

MATERIALS AND METHODS

The study group was made up of 150 untreated essential hypertensive patients (76 males and 74 females), age between 36 and 65 years old. They were recruited from the General Practice Clinic of the Delta State University Teaching Hospital, Warri, Delta State of Nigeria. They were without complications, not being treated for any chronic or longstanding disease at the time of study and had systolic blood pressure of ≥ 150 mmHg or diastolic blood pressure of ≥ 100 mmHg or a combination of both. The control group was made up of 150 apparently healthy individuals (76 males and 74 females), aged between 37 and 65 years old, and had arterial blood pressure of < 140 mmHg (systolic) and < 90 mmHg (diastolic). They were recruited from among the hospital staff and others living in the same environment as the hypertensive patients.

The subjects were selected consecutively from June 1st 2007 to May 31st 2008. Informed consent was obtained and a data acquisition sheet was completed for each subject (Oyejide, 1992).

Parameters measured included weight, height, body mass index $\left(BMI = \frac{Wt(kg)}{Ht(m)^2} \right)$ and blood

pressure (korotkoff method). Subjects with proteinuria or/and glycosuria from urinalysis, generally done for all patients attending the General Practice Clinic, were excluded from the study. So were obese individuals (BMI ≥ 30) and those on any drug such as hormonal contraceptive pills. All the subjects fasted over night for at least 12 hours (Akinyanju *et al.*, 1997), before venous blood was collected the following morning. Plasma total cholesterol levels were determined by enzymatic colorimetric method (Trinder, 1969).

The data obtained were analyzed manually using sharp EL-531LH scientific calculator. The statistical methods applied included means, standard deviation and the student's t-test of independence between variables. The level of significance was set at 5% ($P < 0.05$)

RESULTS

Tables I and 2 show that at each level the hypertensive patients (male and female) had significantly higher mean plasma total cholesterol levels (male = 189 ± 22 mg% and female = 198 ± 34 mg%) than their respective normotensive controls (male = 153 ± 18 mg% and female = 155 ± 15 mg%) ($P < 0.05$). The mean plasma total cholesterol level of the normotensive population (normal healthy Nigerian Africans) for male = 153 ± 18 mg% and female = 155 ± 15 mg%. Although the plasma total cholesterol levels of the females were generally higher than the males, it was not significant; and was not related to age or body mass index.

Table 3 show the distribution of the subjects (hypertensive and non-hypertensive) in the various atherogenic coronary complication groups, using the World Health Organization (WHO) cholesterol classification criteria. Eleven (7.3%) and 21 (14%) of the hypertensive patients were in the high and the borderline coronary risk groups respectively. The other subjects including all the normotensive controls were in the coronary risk-free zone. .

Table I: Mean plasma total cholesterol levels of males of study and control groups

Age (years)	Study group		Control group			
		Mean plasma total cholesterol levels (mg/100ml)		Mean plasma total cholesterol levels (mg/100ml)	Statistical differences between cholesterol levels	'P'-Value
	N		N			
< 36	nil		Nil	-	-	-
36 – 40	6	190 ± 23	6	157 ± 21	2.357	< 0.05
41 – 45	24	198 ± 31	24	151 ± 19	6.184	< 0.05
46 – 50	20	191 ± 30	20	153 ± 17	4.810	< 0.05
51 – 55	11	188 ± 13	11	159 ± 16	4.462	< 0.05
56 – 60	9	193 ± 19	9	148 ± 19	4.737	< 0.05
> 60	6	172 ± 18	6	151 ± 15	2.000	< 0.05
Total	76	189 ± 22	76	153 ± 18	7.879	< 0.05



Table 2 : Mean plasma total cholesterol levels of females of study and control groups

Age (years)	Study group		Control group			
		Mean plasma total cholesterol levels (mg/100ml)		Mean plasma total cholesterol levels (mg/100ml)	Statistical differences between cholesterol levels	'P'-Value
	N		N			
< 36	nil	-	Nil	-	-	-
36 – 40	5	177 ± 34	6	156 ± 13	2.079	< 0.05
41 – 45	27	204 ± 53	26	158 ± 16	4.182	< 0.05
46 – 50	20	227 ± 40	21	162 ± 15	6.771	< 0.05
51 – 55	11	203 ± 37	10	158 ± 13	3.462	< 0.05
56 – 60	6	198 ± 23	6	144 ± 20	3.971	< 0.05
> 60	5	179 ± 18	5	149 ± 13	2.703	< 0.05
Total	74	198 ± 34	74	155 ± 15	10.000	< 0.05



Table 3: The distribution of the subjects in the various atherogenic coronary complication groups

Coronary risk groups/ plasma total cholesterol levels (mg/100ml)	No. of normotensive subjects/%	No. of hypertensive Subjects/%
Risk-free/> 220	150/100	118/79
Borderline (suspicious)/ 220-260	Nil/0	21/14
High risk (requiring treatment)/> 260	Nil/0	11/7
Total	150/100	150/100

DISCUSSION

This study has confirmed the reported (Adedeji *et al.*, 1990), (Bamgboye *et al.*, 1990), (Bonna *et al.*, 1991), (Ames, 1991) significantly higher Tc levels found in hypertensive patients compared to the normal population. This could increase the chances of hypertensive patients developing premature ischaemic heart disease and, presenting first time to the out patient department as sudden death. Tc is currently accepted as an

important risk factor in the pathogenesis of atherosclerosis and other forms of cardiovascular diseases(Gordon,1987). Although Tc determination alone does not indicate whether there is an increase in the atherogenic low-density lipoprotein (LDL) – cholesterol concentration, it is the index that determines whether lipoprotein phenotyping is necessary or not. It is also well established that over 66% of the Tc are carried in the LDL(Gotto,1996). The association of hypercholesterolaemia (found in 7.3% of the hypertensive patients in this study) with premature ischaemic heart disease makes investigation of cholesterol a necessity. Hypercholesterolaemia is associated with vascular endothelial dysfunction which precedes the development of atheroma and may underlie coronary vasospasm(Edington *et al.*,1976). The mean Tc of the healthy normotensive in this study population is within the range reported among African communities by other studies(Adedeji *et al.*,1990),(Bamgboye *et al.*,1990), (Gordon, 1987) , but lower than those reported for the developed societies(American Health Foundation, 1989),(Ononogbu,1994),(Ludewigs *et al.*,1992).

There are few studies in African countries, such as Nigeria, that have actually correlated plasma cholesterol to the risk of developing morbidity and/or mortality from coronary heart disease. This may not be unconnected to the held belief that IHD is rare amongst Africans, hence lack of research interest towards it. In a study by (Das *et al.*, 1997) in which the coronary risk status of 182 normal healthy Nigerian-Africans, aged one year and above, was determined using the internationally accepted “desirable” level of plasma total cholesterol concentrations, all the subjects fell within the coronary risk free zone; same as in this study where all the healthy normotensive subjects were free from the risk of developing coronary heart disease. This is however, at variance with studies on the Caucasians in whom about 10% of the general population was reported to fall within the high risk group(Ludewigs *et al.*,1992).

However, the clinician in Nigeria, nay Africa, should recognize this group of hypertensive patients with hypercholesterolaemia that are at special risk of developing premature ischaemic heart disease, for it is among these group that IHD preventative counseling can be offered. Life style alteration(Adedeji *et al.*,1990), including healthy diet and medical intervention(Lipid Research Clinics Programm,1994) , leading to a fall in Tc level as well as control of high blood pressure have been reported to reduce mortality significantly.

In conclusion, this study confirms that individuals with hypertension have significantly higher Tc levels than the normal population, and this could increase their probability of developing premature IHD. That the presence of hypercholesterolaemia found in some of the studied hypertensive patients may suggest that cardiac abnormalities may be far more frequent than presumed in the Nigeria-African population and therefore warrants much closer attention. And knowing the relationship between high lipid levels and atherosclerosis, efforts should be made to screen all hypertensive patients lipidwise, a practice which should be considered for routine management of the disease. Prudent approach for prevention of IHD is to recommend preventive counseling on diet, especially cutting down on saturated fats, cessation of smoking/excess intake of alcohol and weight loss (where applicable) as well as aggressive blood pressure reduction for every patient diagnosed as hypertensive. The preventive efforts should be made to have impact on the streets, not only on the patients, to halt any drift to an epidemic position. The family physician, being the first-line doctor, has an important role to play in this regard.

REFERENCES

- Adedeji O.O, Onitiri A.C(1990): Plasma lipids in Nigerian Hypertensives. Afr. J Med. Sc. 19(4):281-84.
- Akinkugbe O.O.(1992). In: Expert Committee on Non-communicable Diseases in Nigeria. Series 1. Spectrum Book Publications Ltd. ,Lagos, Nigeria; pp. 3-49.
- Akinyanju P. A. , Banjoko J.D.(1997): Postprandial lipid levels in normal and hyperlipidaemic Nigerians. Nig. Med. J. 7(3): 264-67.
- American Health Foundation(1989): Conference on the effects of blood lipids: Optimal distributions for population.Prev. Med. 8: 715-32.
- Ames R.P.(1991): Hyperlipidaemia in hypertension: Causes and preventions. Am. Heart J. 122(42): 1219-24.
- Anderson K.M., Wilson P.W.F., Odell P.M.(1991): An updated coronary risk profile. Circulation 83: 357-63.

Bamgboye A.E. and Taylor G.O.(1990): Serum Cholesterol and Disease in Nigerians. Am. J. Clin. Nutr. 32: 2540 – 45.

Bonaa K.H. and Thelle D.S.(1991): Association Between Blood Pressure and Serum Lipids in a population: The Tromso Study. Circulation 83: 1305- 14.

British Cardiac Society Working Group(1987): On Coronary Heart Disease Prevention. Br. Med. J. 299: 1475 – 76.

Das S.C. and Isichei U.P.(1997): Beta lipoprotein and Triglycerides in a healthy Nigerian Population. Nig. Postgrad. Med. J. 4(3): 88-92.

Edington G.M. and Gilles H.M.(1976). The circulatory system, In:Edington G.M. and Gilles H.M. (eds). Pathology in the tropics. Arnold Publishers, London; pp. 348 – 89.

Gordon T.(1987): Blood Lipids in Coronary heart disease risk: The Framingham Study. Ann. Int. Med. 87: P. 393.

Gotto A.M.(1996): The cholesterol Facts - A summary of the evidence relating dietary fats, serum cholesterol and coronary heart disease. Circulation 81: 1721 – 33.

Lipid Research Clinics Programm(1994): The lipid Research Clinics Coronary primary prevention trial results: the relationship of reduction in incidence of coronary heart disease to cholesterol lowering.J.A.M.A.251:365-74.

Ludewigs M. , Ceranna R. , and Timpin C.(1992): Diagnostic Report - Lipid Disorders. No.E4221. Boehringer Mannheim, West Germany; pp. 1-20.

Ononogbu I.C.(1994): Comparison of high density lipoprotein and serum cholesterol levels in a European and an African community. Atherosclerosis.90: 34-52.

Osuntokun B.O.(1987): Stroke in Africans. Afr. J. Med. Sc.6: 39- 53.

Oyejide C.O.(1992):Health Research Methods for Developing Country Scientists. Codat Publications, Ibadan, Nigeria; pp.59-63.

Trinder P.(1969): Determination of serum cholesterol by enzymatic colometric method. Ann.Clin. Biochem. 6: 24-27.

W.H.O. Expert Committee(1990). Prevention of Coronary Heart Disease. In: World Health Organisation Technical Report. Series 678. Geneva.

Received for Publication: 07/03/2009

Accepted for Publication: 24/05/2009

Corresponding Author:

Awusi Vincent O.

P.M. Box 8957, Benin, Benin City, Edo State, Nigeria.

E-MAIL: alpha.medicalcentre@yahoo.com